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AN EVALUATION OF SEEDLING MORTALITY IN THE MYRTLE CREEK PROGENY TEST SITE, GASQUET RANGER DISTRICT, SIX RIVERS NATIONAL FOREST

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ABSTRACT

Two areas of seedling mortality in two different blocks in Set 2 were examined for causal factors. In Block 3, an area with 10 dead seedlings was found. Trees have died annually since being planted in 1980. All dead seedlings examined had evidence of infection by black stain root disease. A second mortality spot was observed in Block 6 involving 3 seedlings. The roots of two of these seedlings were growing in contact with root debris from the previous stand. Both the seedlings and debris had evidence of Armillaria root disease. The third seedling had died more recently and had evidence of black stain root disease at its root collar.

INTRODUCTION

At the request of Tree Improvement Project personnel (Detection Report 222), I visited the Myrtle Creek progeny test site (T. 17N, R. 1E, section 27), Gasquet Ranger District, Six Rivers National Forest on October 18, 1984. This test site was planted in the spring of 1980 with Douglas-fir. Seedling mortality has been recorded by TIP personnel in three areas over the past three years. These areas are in Blocks 3 and 6 of Set 2.

I looked at two of the mortality areas during my visit, one in each block. The area in Block 3 involved 10 dead seedlings that have died since planting. Only one live seedling within the mortality pocket had above ground symptoms of decline. The recently dead seedlings had no evidence of decline prior to mortality, i.e., size and height growth were comparable to live seedlings in the Block. Seedlings appeared to die suddenly. Several seedlings that died in 1984 had begun needle and stem elongation in the spring just prior to mortality. I examined the more recent mortality for causal factors. The examined seedlings had symptoms typical of black stain root disease (Verticicladiella wageneri) at the root collar.

I dug up two seedlings (Nos. 1690 and 1423) from Block 3 for closer examination in the laboratory. Root development appeared adequate, although the influence of the nursery container was still evident by the compact region of roots for the first 6 to 8 inches. Roots smaller than 1/2-inch diameter were dead and, in some cases, decaying. In some of the smaller feeder roots, there appeared to be black stain of V. wageneri. The stain was more definitive in the larger roots and extended into the lower stem. Through microscopic examination of stained woody tissue, I confirmed V. wageneri as the cause of this stain.

Seedling 1690 had extensive boring and boring dust in the phloem/cambium region caused by roundheaded borers (Buprestidae). Larvae of these borers were found, but the species of insect involved could not be determined. No other insect activity could be identified in these two seedlings, but the condition of much of the root system obviated my ability to make accurate observations.

I dug up a third seedling (No. 6090) from Block 6. Two additional dead seedlings were in this mortality spot. In the soil in contact with the roots of 6090 were large chunks of wood that remained from the previous stand following site preparation. Mycelial fans of Armillaria mellea were present on this debris. The larger roots of the seedling also had mycelial fans in the cambium region. In addition to A. mellea, I observed stain of V. wageneri in the roots and lower stem. The stem had been successfully attacked by the Douglas-fir engraver, Scolytus unispinosus.

Attempts at isolating V. wageneri from the seedlings were unsuccessful. Non-selective techniques were used, thereby reducing the possibility of isolating the fungus. However, it is also possible that the fungus was not viable in the dead seedlings. Because of the non-competitive nature of the fungus and the small mass of the root systems, survival of the fungus in the dead seedlings is expected to be limited.

BIOLOGY OF VERTICICLADIELLA WAGENERI

Verticicladiella wageneri is a fungus that causes a vascular wilt of Douglas-fir and several species of pine. The strain of the fungus that infects Douglas-fir is specific to that host. The fungus is generally limited to the roots and lower stem. Symptoms of the disease include a black staining of the wood, loss of needles, reduction in height growth, a stress crop of cones, and eventual mortality.

The fungus is carried from one pine host to another by insect. It is believed that this is true for Douglas-fir also. The suspected insects feed and develop in the inner bark of dying and weakened roots. During this process they transmit the fungus to the tree and their brood pick up spores on exiting. Once introduced, the fungus grows through the woody root tissue toward the root collar and into other roots. The fungus can be transmitted to other trees where infected roots contact healthy roots. This results in the development of expanding pockets of root disease-caused mortality. There is also some evidence of direct infection of roots from the soil, but this has not yet been confirmed in Douglas-fir.

RECOMMENDATION

There are several unanswered questions about the situation at Myrtle Creek. Until it is known how infection is occurring in these areas, whether it is directly from the soil, from insects, or from infected buried woody debris, a set of management alternatives cannot be developed. It is recommended that this test site continue to be monitored very closely for declining and dead seedlings, especially in these areas of known infection. In addition, a closer examination of these areas should be done by FPM in an attempt to gather more answers when weather conditions are more conducive to such observations.